CLAIMS

What is claimed is:

1. A system for servoing on a moving target within a dynamic scene, comprising:

a master variable pointing camera system;

a plurality of slave variable pointing camera systems, wherein the slave variable pointing camera systems and the master variable pointing camera system are positioned around the scene;

a master control unit in communication with the master variable pointing camera system for determining, based on parameters of the master variable pointing camera system, parameters for each of the slave variable pointing camera systems such that, at a point in time, the master variable pointing camera system and the slave variable pointing camera systems are aimed at the target and a size of the target in an image from each of the master variable pointing camera system and the slave variable pointing camera systems is substantially the same; and

a plurality of slave camera control units in communication with the master control unit, wherein each slave camera control unit is for controlling at least one of the slave variable pointing camera systems based on the parameters for each of the slave variable pointing camera systems.

2. The system of claim 1, wherein the parameters of the master variable pointing camera system and the parameters for the slave variable pointing camera systems include pointing parameters and optical parameters.

3. The system of claim 2, wherein :

the master variable pointing camera system includes a master pan/tilt camera system; and

the plurality of slave variable pointing cameras includes a plurality of slave pan/tilt camera systems.

4. The system of claim 3, wherein the wherein the parameters of the master variable pointing camera system and the parameters for the slave variable pointing camera systems include pan, tilt, zoom and focus parameters.

5. The system of claim 2, further comprising a video image sequence generator in communication with the master control unit and the slave camera control units.

6. The system of claim 5, wherein the video image sequence generator is for generating a video image sequence of the target by outputting an image from certain of the master variable pointing camera system and the slave variable pointing camera systems in sequence according to the position of the master variable pointing camera system and the slave variable pointing camera systems around the scene.

7. The system of claim 5, further comprising a computer vision control unit in communication with the master control unit and the master variable pointing camera system.

8. The system of claim 5, further comprising a remote operator interface unit in communication with the master control unit and the master variable pointing camera system.

9. The system of claim 5, wherein the master control unit includes:

a target determination module for determining a position of the target within the scene and a size of the target at the position in an image from the master variable pointing camera system based on the parameters of the master variable pointing camera system; and

a slave control module in communication with the target determination module for determining the parameters for each of the slave variable pointing camera systems based on the position of the target and the size of the target in the image from the master variable pointing camera system.

10. A system for servoing on a moving target within a dynamic scene, comprising:

a plurality of variable pointing camera systems positioned around the scene;

a master control unit in communication with a first of the variable pointing camera systems for determining, based on parameters of the first variable pointing camera system, parameters for at least a second variable pointing camera system such that, at a point in time, the first and second variable pointing camera systems are aimed at the target and a size of the target in an image from the first and second variable pointing camera systems is substantially the same; and

a slave camera control unit in communication with the master control unit for controlling the second variable pointing camera system based on the determined parameters for the second variable pointing camera system.

11. The system of claim 10, wherein the parameters of the first and second camera systems pointing parameters and optical parameters.

12. The system of claim 11, wherein the first and second variable pointing camera systems include first and second pan/tilt camera systems.

13. The system of claim 12, wherein the wherein the parameters of the first and second camera systems include pan, tilt, zoom and focus parameters.

14. The system of claim 11, further comprising a video image sequence generator in communication with the master control unit and the slave camera control units.

15. The system of claim 14, wherein the video image sequence generator is for generating a video image sequence of the target by outputting an image from at least the first and second variable pointing camera systems in sequence according to the position of the variable pointing camera systems around the scene.

16. The system of claim 14, further comprising a computer vision control unit in communication with the master control unit and the first variable pointing camera system.

17. The system of claim 14, further comprising a remote operator interface unit in communication with the master control unit and the first variable pointing camera system.

18. The system of claim 14, wherein the master control unit includes:

a target determination module for determining a position of the target within the scene and a size of the target at the position in an image from the first variable pointing camera system based on the parameters of the first variable pointing camera system; and

a slave control module in communication with the target determination module for determining the parameters for the second variable pointing camera system based on the position of the target and the size of the target in the image from the first variable pointing camera system.

19. A system for servoing on a moving target within a dynamic scene, comprising:

a master variable pointing camera system;

a plurality of slave variable pointing camera systems, wherein the slave variable pointing camera systems and the master variable pointing camera system are positioned around the scene;

means for determining, based on parameters of the master variable pointing camera system, parameters for each of the slave variable pointing camera systems such that, at a point in time, the master variable pointing camera system and the slave variable pointing camera systems are aimed at the target and a size of the target in an image from each of the master variable pointing camera system and the slave variable pointing camera systems is substantially the same; and

means for controlling the slave variable pointing camera systems based on the parameters for each of the slave variable pointing camera systems.

20. The system of claim 19, wherein the means for determining parameters for each of the slave variable pointing camera systems includes:

a target determination module for determining a position of the target within the scene and a size of the target at the position in an image from the master variable pointing camera system based on the parameters of the master variable pointing camera system; and

a slave control module in communication with the target determination module for determining the parameters for each of the slave variable pointing camera systems based on the position of the target and the size of the target in the image from the master variable pointing camera system.

21. The system of claim 20, wherein the means for controlling the slave variable pointing camera systems includes at least one servo control module in communication with the slave control module.

22. The system of claim 21, wherein the servo control module is for communicating parameter commands to the slave variable pointing camera systems to control the slave variable pointing camera systems based on the parameters for the slave variable pointing camera systems.

23. The system of claim 19, further comprising:

means for storing digitized, time-stamped images from the master variable pointing camera system and the slave variable pointing camera systems; and

means for generating a video image sequence of the target by outputting an image from certain of the master variable pointing camera system and the slave variable pointing camera systems in sequence according to the position of the master variable pointing camera system and the slave variable pointing camera systems around the scene.

24. The system of claim 23, wherein the means for generating a video image sequence includes a frame-sequencing module in communication with the means for storing digitized, time-stamped video images.

25. The system of claim 23, further comprising means for allowing a reviewer to review images from at least one of the master variable pointing camera system and the slave variable pointing camera systems.

26. The system of claim 19, further comprising computer vision means for controlling the master variable pointing camera system.

27. The system of claim 19, further comprising remote operator interface means for controlling the master variable pointing camera system.

28. A method for servoing on a moving target within a dynamic scene, comprising:

reading parameters of a first variable pointing camera system;

determining parameters for a plurality of other variable pointing camera systems based on the parameters of the first variable pointing camera system, wherein the first variable pointing camera system and the plurality of other variable pointing camera systems are positioned around the scene, such that, at a point in time, each of the variable pointing camera systems is aimed at the target and a size of the target in an image from each of the variable pointing camera systems is substantially the same; and

controlling the plurality of other variable pointing camera systems based on the parameters for the plurality of other variable pointing camera systems.

29. The method of claim 28, wherein:

reading parameters of the first variable pointing camera system includes reading mechanical and optical parameters of the first variable pointing camera system; and

determining parameters for the plurality of other variable pointing camera systems includes determining mechanical and optical parameters for the plurality of other variable pointing camera systems.

30. The method of claim 29, wherein the first variable pointing camera system includes a first pan/tilt camera system, wherein the plurality of other variable pointing camera systems include a plurality of other pan/tilt camera systems, and wherein

reading parameters of the first pan/tilt camera system includes reading pan, tilt, zoom and focus parameters of the first pan/tilt camera system; and

determining parameters for the plurality of other pan/tilt camera systems includes determining pan, tilt, zoom and focus parameters for the plurality of other pan/tilt camera systems.

31. The method of claim 28, further comprising:

storing digitized, time-stamped images from the master variable pointing camera system and the slave variable pointing camera systems; and

generating a video image sequence of the target by outputting an image from certain of the master variable pointing camera system and the slave variable pointing camera systems in sequence according to the position of the master variable pointing camera system and the slave variable pointing camera systems around the scene.

32. The method of claim 28, wherein determining parameters for the plurality of other variable pointing camera systems includes:

determining a position of the target within the scene and a size of the target at the position in an image from the master variable pointing camera system based on the parameters of the master variable pointing camera system; and

determining the parameters for each of the slave variable pointing camera systems based on the position of the target and the size of the target in the image from the master variable pointing camera system.

33. The method of claim 28, further comprising selecting one of the slave variable pointing camera systems to be the master variable pointing camera system.

34. A method of calibrating a plurality of variable pointing camera systems positioned around a scene, comprising:

determining a geometric relationship of the variable pointing camera systems to the scene;

determining a relationship between camera zoom for each variable pointing camera system and angular field of view; and

determining a relationship between camera focus for each variable pointing camera system and depth of field.

35. The method of claim 34, wherein determining the geometric relationship includes determining a pose for each variable pointing camera system by measuring, for each camera system, pointing angles for a plurality of landmarks with known 3D coordinates.

36. The method of claim 35, wherein determining the pose for each variable pointing camera system includes determining the pose for each variable pointing camera system by measuring, for each camera system, pointing angles for three or more landmarks with known 3D coordinates.

37. The method of claim 35, wherein determining the relationship between camera zoom for each variable pointing camera system and angular field of view includes measuring the angular field of view for a plurality of zoom settings for each camera system.

38. The method of claim 35, wherein determining the relationship between camera focus for each variable pointing camera system and depth of field includes:

focusing, with each camera system, on a plurality of objects at different distances from the camera systems; and

determining a relationship between focus value and distance for each camera system.

39. The method of claim 38, wherein determining the relationship between focus value and distance for each camera system includes determining the relationship between focus value and distance for each camera system for a lookup table of focus parameter settings indexed by inverse distance to desired focal distance in the scene.

40. A system for servoing on a moving target within a dynamic scene, comprising:

a plurality of master variable pointing camera systems;

a plurality of slave variable pointing camera systems, wherein the slave variable pointing camera systems and the master variable pointing camera systems are positioned around the scene;

at least one master control unit in communication with each of the master variable pointing camera systems for determining, based on parameters of the master variable pointing camera systems, parameters for certain of the plurality of the slave variable pointing camera systems such that, at a point in time, each of the master variable pointing camera systems and the slave variable pointing camera systems are aimed at the target and a size of the target in an image from each of the master variable pointing camera systems and the slave variable pointing camera systems is substantially the same; and

a plurality of slave camera control units, each slave camera control unit in communication with at least one of the master control units, wherein each slave camera control unit is for controlling at least one of the slave variable pointing camera systems based on the parameters for each of the slave variable pointing camera systems.

41. The system of claim 40, wherein the at least one master control unit includes a plurality of master control units, and wherein each of the master control units is in communication with at least one master variable pointing camera system and is for determining, based on parameters of the master variable pointing camera systems, parameters for certain of the plurality of the slave variable pointing camera systems such that, at a point in time, each of the master variable pointing camera systems and the slave variable pointing camera systems are aimed at the target and a size of the target in an image from each of the master variable pointing camera systems and the slave variable pointing camera systems is substantially the same.